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(19) (CA) APPLICATION FOR CANADIAN PATENT (12)

(54) Alkenylsuccinic Acid Derivatives as Metalworking
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(57) 14 Claims

Notice: This application is as filed and may therefore contain an
incomplete specification.

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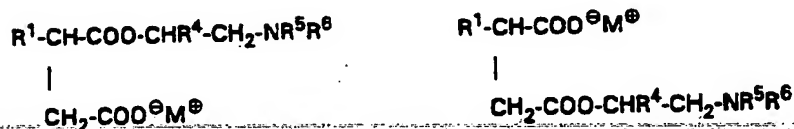
Abstract

Alkenylsuccinic acid derivatives as metalworking auxiliaries

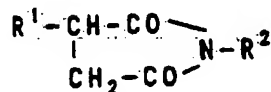
The present invention relates to salts of alkenylsuccinic acid alkoxyalkyl-half-amides of the formula Ia and/or Ib



if appropriate as a mixture with salts of alkenylsuccinic acid half-ester amines of the formula IIa and/or IIb



and/or alkenylsuccinic acid imides of the formula III

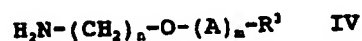


in which R¹, R², A, R³, R⁴, n, m and M⁺ have the meaning given in the description.

The invention also relates to a process for the preparation of salts of alkenylsuccinic acid alkoxyalkyl-half-amides of the formula Ia and/or Ib, if appropriate as a mixture with salts of alkenylsuccinic acid half-ester amines of the formula IIa and IIb and/or alkenylsuccinic acid imides of the formula III, which comprises reacting alkenylsuccinic acid anhydrides with alkoxyalkylamines of the formula IV

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in which R^1 , n , m and A have the meaning given in the description, and carrying out this reaction in the presence of an amount of base equimolar to the alkoxy-alkylamines of the formula IV, or adding an amount of
5 base equimolar to the alkoxyalkylamines of the formula IV after the reaction.

The invention furthermore relates to aqueous and/or oil-containing formulations for working metals, which
10 comprise the abovementioned salts of alkenylsuccinic acid alkoxyalkyl-half-amides of the formula Ia and/or Ib, if appropriate as a mixture with salts of alkenylsuccinic acid half-ester amines of the formula IIa and/or IIb and/or alkenylsuccinic acid imides of the formula III,
15 and their use as anticorrosion agents, cooling lubricants and metalworking auxiliaries.

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Description

Alkenylsuccinic acid derivatives as metalworking auxiliaries

- 5 The use of metalworking auxiliaries extends to numerous working processes for pre- and after-treatment of metals. The field of work comprises cutting and non-cutting shaping of metal components. Drilling and cutting oils are employed for cutting shaping, and milling and drawing oils are employed for non-cutting shaping.
- 10 Anticorrosion agents and emulsifiers in emulsifiable metalworking fluids should meet the following requirements:
1. pronounced corrosion protection properties with respect to ferrous metals
 - 15 2. emulsifying power with respect to mineral oils, possibly also in combination with selected nonionic compounds
 3. low tendency to foam or rapid collapse of foam
 4. prevention of the growth of microorganisms
- 20 These requirements are only partly met by the compounds which are already known. Salts of C_6 - C_{12} -alkenylsuccinic acid half-amides and their use as anticorrosion agents are known from EP-A-127 132. However, these compounds do not exhibit an adequate
- 25 emulsifying power, which leads to inadequate service lives of the emulsion to be used. Furthermore, emulsions comprising these compounds tend to foam, which is a disadvantage in particular during working processes such as grinding, when the emulsions are exposed to high
- 30 mechanical influences.

Alkanolamine salts of C_6 - C_{18} -alkenylsuccinic acid half-amides, where a primary amine having a C_1 - C_{10} -alkyl chain is employed for half-amide formation, are described in DE-A-33 00 874.

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DE-A-33 41 013 describes C₆-C₁₀-alkenylsuccinic acid half-amides, where secondary amines having 1 to 10 carbon atoms are employed for the half-amide formation.

The abovementioned requirements also cannot be met in
5 full by the use of these compounds.

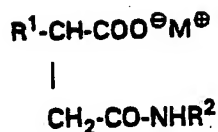
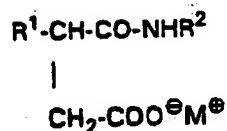
The object of the invention is to provide derivatives of alkenylsuccinic acids which combine the properties described above.

10 Surprisingly, it has now been found that this object can be achieved by salts of alkenylsuccinic acid half-amides which contain alkoxyalkylamines as the amine component, if appropriate as a mixture with salts of alkenylsuccinic acid half-amides which contain an alcoholamine as the ester group, and alkenylsuccinic acid imides.

15 The invention relates to salts of alkenylsuccinic acid alkoxyalkyl-half-amides of the formula Ia and/or Ib

Ia

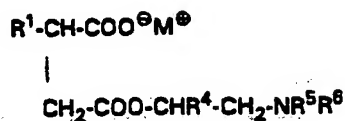
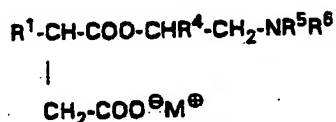
Ib



if appropriate as a mixture with salts of alkenylsuccinic acid half-ester amines of the formula IIa and/or IIb

IIa

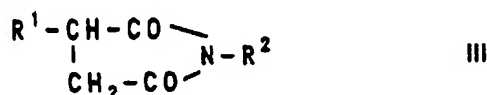
IIb



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and/or alkenylsuccinic acid imides of the formula III



in which

- 5 R^1 is C_1 - C_{30} -alkenyl or C_1 - C_{30} -alkyl, preferably C_1 - C_{18} -alkenyl or C_1 - C_{18} -alkyl, in which R^1 can be straight-chain or branched;
- R^2 is $-(\text{CH}_2)_n-\text{O}-(\text{A})_m-\text{R}^3$, where
- A is $-\text{CH}_2-\text{CH}_2-\text{O}-$ or $-\text{CH}(\text{R}^4)-\text{CH}_2-\text{O}-$, in which
- R^3 is C_1 - C_{18} -alkyl, and in which R^3 can be straight-chain or branched,
- 10 R^4 is hydrogen or methyl,
- n is a number from 1 to 6,
- m is a number from 0 to 8 and
- M^+ is an alkali metal or alkaline earth metal cation or an ammonium ion of the formula $\text{HNR}^5\text{R}^6\text{R}^7$, in which R^5 ,
- 15 R^6 and R^7 are identical or different and are hydrogen, C_1 - C_4 -alkyl or hydroxy- $(\text{C}_1$ - C_4)-alkyl, in particular
- 2-hydroxyethyl and 2-hydroxypropyl.

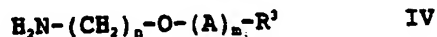
- 20 The alkenylsuccinic acid half-ester amine salts of the formula IIa and IIb and the alkenylsuccinic acid imides of the formula III can occur as by-products during preparation of the alkenylsuccinic acid alkoxyalkyl-half-amide salts of the formula Ia and Ib and are usually present in concentrations of 0 to 40 % by weight, preferably
- 25 0 to 20 % by weight, as a mixture with the alkenylsuccinic acid alkoxyalkyl-half-amide salts of the formula Ia and Ib.

- 30 The invention likewise relates to a process for the preparation of salts of alkenylsuccinic acid alkoxyalkyl-half-amides of the formula Ia and/or Ib, if appropriate as a mixture with salts of alkenylsuccinic acid half-ester amines of the formulae IIa and/or IIb and/or alkenylsuccinic acid imides of the formula III, which

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comprises reacting alkenylsuccinic acid anhydrides with alkoxyalkylamines of the formula IV



in which

- 5 R^1 is C_1 - C_{18} -alkyl, in which R^1 can be straight-chain or branched,
 n is a number from 1 to 6 and
 m is a number from 0 to 8,
in a molar ratio of 1 : 0.7 to 2.5, preferably 1 : 0.8
10 to 1.2, at temperatures of 20 to 120°C, preferably 60 to 100°C, and carrying out this reaction in the presence of an amount of base which is equimolar to the alkoxyalkylamines of the formula IV, or adding an amount of base equimolar to the alkoxyalkylamines of the formula IV
15 after the reaction.

Bases which are employed are alkali metal hydroxides, alkaline earth metal hydroxides, alkanolamines of the formula NR^2R^3 or mixtures thereof.

- 20 The base is usually employed in an amount equimolar to the alkanolamines.

- The preparation of the alkenylsuccinic acid anhydrides used as starting materials is carried out by reaction of olefins and maleic anhydride and is known. Preferred
25 olefins are oligomers of ethylene, propylene and butylene, and olefins having an internal double bond. For example, n-dodecenylsuccinic anhydride can be prepared by reaction of n-dodec-1-ene with maleic anhydride at temperatures of 150 to 230°C under a pressure of 3 to 10 bar in the presence of suitable free radical
30 inhibitors. The alkenylsuccinic acid anhydrides thus obtained can be employed for the preparation of the compounds according to the invention either after purification by distillation or recrystallization or directly.

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The alkoxyalkylamines, for example 2-hydroxyethylamine, can be prepared by addition of acrylonitrile onto alcohols and subsequent hydrogenation.

5 The salts of alkenylsuccinic acid alkoxyalkyl-half-amides of the formula Ia and/or Ib according to the invention, if appropriate as a mixture with salts of alkenylsuccinic acid half-ester amines of the formula IIa and/or IIb and/or alkenylsuccinic acid imides of the formula III are used as metalworking auxiliaries, in particular as
10 anticorrosion agents and an emulsifier in aqueous and/or oil-containing formulations or metalworking fluids.

The invention likewise relates to aqueous and/or oil-containing formulations for working metals, in particular for use as cooling lubricants, which comprise the above-
15 mentioned salts of alkenylsuccinic acid alkoxyalkyl-half-amides of the formula Ia and/or Ib, if appropriate as a mixture with salts of alkenylsuccinic acid half-ester amines of the formula IIa and/or IIb and/or alkenylsuccinic acid imides of the formula III.

20 The alkenylsuccinic acid alkoxyalkyl-half-amide salts of the formula Ia and/or Ib prepared by the processes described above, if appropriate as a mixture with salts of alkenylsuccinic acid half-ester amines of the formula IIa and/or IIb and/or alkenylsuccinic acid imides
25 of the formula III, form a clear solution in water and, with mineral oil, give formulations which are readily emulsifiable in water. These compounds are employed in concentrated form as emulsifiers and anticorrosion agents in oil-containing and/or aqueous formulations. The
30 concentration of the alkenylsuccinic acid alkoxyalkyl-half-amide salts of the formula Ia and/or Ib, if appropriate as a mixture with salts of alkenylsuccinic acid half-ester amines of the formula IIa and/or IIb and/or alkenylsuccinic acid imides of the formula III, in the
35 formulation is higher than that during use and is usually 10 to 80 % by weight. The formulation is diluted with

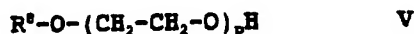
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water for cutting or non-cutting shaping, such as, for example, in drilling, cutting, drawing and milling fluids. To prepare the formulations, the products according to the invention are either stirred into the
5 required amount of water or mixed with mineral oil or mineral oil/water. The resulting aqueous or oil-containing formulations are usually diluted or emulsified with water before use. The dilution ratio is in general 1 : 10 to 1 : 100. The use concentration of the alkenylsuccinic
10 acid alkoxyalkyl-half-amide salts in metalworking fluids, for example drilling, cutting, drawing and milling fluids, is in general about 0.1 to 10 % by weight, preferably 2 to 10 % by weight. The concentration mentioned relates both to the use of the products in water
15 and to their use in mineral oil/water emulsions during metalworking. Metalworking fluids are also to be understood as meaning cooling lubricants.

The alkenylsuccinic acid alkoxyalkyl-half-amide salts are employed as an emulsifier with corrosion protection in
20 aqueous metalworking fluids containing mineral oil and as an anticorrosion agent in aqueous metalworking fluids which are free from mineral oil. They are suitable for mixing with customary mineral oils, in particular with naphthene-based and paraffin-based mineral oils and
25 mineral oils on a mixed basis.

The formulations or metalworking fluids can comprise additional auxiliaries for optimizing the emulsifying properties and the corrosion protection. Auxiliaries which are particularly advantageous for this purpose are
30 oxyethylates of the formula V



in which R^p is C_{10} - C_{22} alkyl, C_{10} - C_{22} alkenyl or alkylphenyl having a total of 10 to 20 carbon atoms and p is a number from 2 to 10.

35 Fatty acid alkanolamides of the formula VI

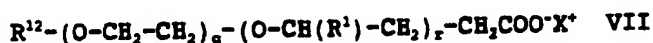
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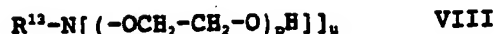
VI

- in which R^9 is $C_{10}-C_{22}$ alkyl or $C_{10}-C_{22}$ alkenyl and R^{10} and R^{11} are identical or different and are hydrogen or hydroxy- (C_1-C_4) -alkyl, in particular 2-hydroxyethyl or
- 5 2-hydroxypropyl, can also be employed as auxiliaries. Further suitable auxiliaries are ether-carboxylic acids of the formula VII



- in which
- 10 R^{12} is a branched or unbranched C_8-C_{22} alkyl or C_8-C_{22} alkenyl radical and q and r independently of one another can assume values from 0 to 10, with the proviso that the sum of q and r is at least 1 and X is hydrogen or an alkali metal atom or alkaline
- 15 earth metal atom.

Auxiliaries which are likewise suitable are alkoxyated primary amines of the formula VIII



- in which
- 20 R^{13} is $C_{12}-C_{20}$ -alkyl, or alkenyl, preferably $C_{16}-C_{18}$ -alkyl, p is a number from 2 to 10, preferably 4 to 6, and u is the number 1 or 2, with the proviso that if u is 1 a hydrogen atom is located on the free bond of the nitrogen atom.

- 25 Other suitable auxiliaries are also fatty acid polyglycol esters, in particular of saturated or unsaturated fatty acids having 10 to 22 carbon atoms in the alkyl chain and 1 to 10 ethylene oxide units, such as oleic acid having 4 to 6 ethylene oxide units. The formulations in general
- 30 comprise these auxiliaries individually or in mixtures in amounts of in each case about 20 to 40 % by weight. The formulations for this purpose furthermore can comprise

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customary additives, such as foam suppressants or suitable perservatives.

- The terms used below for characterization, such as acid number, amine number, base nitrogen and iodine color number, are determined or ascertained as follows:

Determination of the acid number:

- To determine the acid number, stated in mg of KOH/g of substance, 0.1 to 0.5 g of the sample is weighed into a 150 ml glass beaker and dissolved in 60 to 80 ml of ethanol and the solution is titrated with 0.1 N ethanolic potassium hydroxide solution. The end point is indicated potentiometrically (apparatuses: Metrohm Titroprocessor 682, Dosimat 665 with combined pH glass electrode).

- 15 Ascertaining the base nitrogen and the amine number:
To ascertain the base nitrogen, stated in % of N, 0.1 to 0.5 g of the sample is weighed into a 150 ml glass beaker and dissolved in 60 to 80 ml of glacial acetic acid and the solution is titrated with 0.1 N perchloric acid in glacial acetic acid. The end point is indicated potentiometrically (apparatuses: Metrohm Titroprocessor 682, Dosimat 665 with combined pH glass electrode).
The amine number, stated in mg of KOH/g of substance, is calculated from the value for the base nitrogen from the
25 formula:

$$\text{amine number [mg of KOH/g]} = \% \text{ of base N} \times 5.61/0.140067$$

- The iodine color number denotes the concentration of free iodine in an iodine/potassium iodide solution (in mg of iodine per 100 ml of iodine/potassium iodide solution) and serves to characterize the color or transparency of this solution and liquids of a similar type. The basis for the determination of the iodine color number is the iodine color scale (comparison tubes). Literature:

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DIN 53403.

The following embodiment examples illustrate the present invention without limiting it:

Examples:

5 Example 1

Preparation of $C_{12/14}$ -alkenylsuccinic acid 3-butoxypropyl-half-amide triethanolammonium salt

A mixture of 127.5 g (1.0 mol) of 3-n-butoxypropylamine, 149.1 g (1.0 mol) of triethanolamine and 30 g of water
10 was initially introduced into a 1 l three-necked flask with a stirrer, internal thermometer and reflux condenser, and 279.2 g (hydrolysis number: 401.9 mg of KOH/g; 1 mol) of technical grade $C_{12/14}$ -alkenylsuccinic acid anhydride (chain distribution of the starting olefin
15 mixture: 65 % by weight of dodecene, 35 % by weight of tetradecene) were metered in over a period of 0.5 hours (exothermic reaction). The internal temperature was limited to not more than 50°C by periodic cooling. When the addition had ended, the mixture was subsequently
20 stirred at 50°C for a further 2 hours. At this point in time, the reaction mixture contained about 67 % of $C_{12/14}$ -alkenylsuccinic acid 3-n-butoxypropyl-half-amide triethanolammonium/3-butoxypropylammonium salt and about 33 % of $C_{12/14}$ -alkenylsuccinic acid triethanolamine ester 3-n-butoxypropylammonium/triethanolammonium salt (determined
25 by base N determination).

The reaction mixture was rendered alkaline by addition of 48 g (0.6 mol) of a 50 % strength sodium hydroxide solution. 642.1 g of a pale brown-yellow liquid having an
30 iodine color number of 30 to 40, an amine number (determined potentiometrically) of 171 mg of KOH/g, an acid number of 46 mg of KOH/g and a viscosity of 1.9 Pas (Brookfield, 28°C, 10 revolutions per minute) were obtained.

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Example 2

Preparation of C_{12/14}-alkenylsuccinic acid 3-methoxypropyl-half-amide triethanolammonium salt

44.6 g (0.5 mol) of 3-methoxypropylamine were initially introduced into the apparatus described in Example 1 at 30°C and 139.6 g (hydrolysis number: 401.9 mg of KOH/g; 0.5 mol) of technical grade C_{12/14}-alkenylsuccinic acid anhydride (chain distribution of the starting olefin mixture: 65 % by weight of dodecene, 35 % by weight of tetradecene) were added dropwise in the course of 30 minutes (exothermic reaction), the internal temperature being kept at not more than 50°C by periodic cooling. When the addition had ended, the mixture was subsequently stirred at 50°C for a further 2 hours (conversion according to control of the base N > 98 %) and was neutralized by addition of 74.5 g (0.5 mol) of triethanolamine. Finally, the reaction mixture was rendered alkaline by addition of 39 g of a 30 % strength sodium hydroxide solution (pH (1 % in demineralized water): 8.4). 296 g of a dark yellow liquid having an iodine color number of 20, an amine number (potentiometric determination) of 151 mg of KOH/g and an acid number of 50.6 mg of KOH/g were obtained.

Example 3

25 Preparation of C_{12/14}-alkenylsuccinic acid 3-butoxypropyl-amide methyldiethanolammonium salt

55.8 g (0.2 g) of technical grade n-C_{12/14}-alkenylsuccinic acid anhydride were added dropwise to a mixture of 25.5 g (0.2 mol) of 3-butoxypropylamine, 23.8 g (0.2 mol) of N-methyl-diethanolamine and 6 g of demineralized water in the course of 30 minutes, starting at 30°C (exothermic reaction), the internal temperature being kept at 50°C by periodic cooling, and the mixture was subsequently stirred at 50°C for 2 hours. At this point in time, the

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reaction mixture contained, according to analysis (base N) about 86 % of n-C_{12/14}-alkenylsuccinic acid 3-butoxypropyl-half-amide triethanolammonium/3-butoxypropylammonium salt and about 14 % of n-C_{12/14}-alkenylsuccinic acid triethanolamine ester 3-butoxypropylammonium/triethanolammonium salt. When the reaction had ended, the mixture was rendered alkaline with 9.6 g of 50 % strength sodium hydroxide and 119.1 g of a yellowish viscous liquid having an iodine color number of 20, an amine number of 168 mg of KOH/g and an acid number of 51 mg of KOH/g were thus obtained.

Example 4

Preparation of C_{12/14}-alkenylsuccinic acid 3-methoxypropylamide triethanolammonium salt

44.6 g (0.5 mol) 3-Methoxypropylamine was added dropwise to 139.8 g (0.5 mol) of n-C_{12/14}-alkenylsuccinic acid anhydride in the course of 0.5 hours, with periodic cooling, such that the internal temperature did not exceed 50°C, and the mixture was subsequently stirred for 1 hour and neutralized with a mixture of 75.6 g of triethanolamine and 14.2 g of water to give, after post-reaction for 1 hour at 50°C, a reaction mixture having a half-amide/ester ratio of 93.7 (analysis by base N). After the mixture had been rendered alkaline with 24 g of 50 % strength sodium hydroxide solution, 291.6 g of a dark yellow liquid having an amine number of 160 mg of KOH/g, an acid number of 46 mg of KOH/g and a viscosity of 2.3 Pas were obtained.

Example 5

Preparation of tripropenylsuccinic acid 3-methoxypropylamide triethanolammonium salt

111.5 g (0.5 mol) of technical grade tripropenylsuccinic anhydride were added dropwise to a mixture of 44.6 g (0.5 mol) of 3-methoxypropylamine, 74.5 g (0.5 mol) of

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triethanolamine and 13.6 g of water in the course of 0.5 hours, starting at 30°C, with periodic cooling, such that the internal temperature did not exceed 50°C, and the mixture was then subsequently stirred at this temperature for a further 2 hours. At this point in time, the reaction mixture contained about 63 % of half-amide and 37 % of half-ester. After the mixture had been rendered alkaline with 24 g of 50 % strength sodium hydroxide solution, 266.2 g of a pale yellow viscous liquid having an amine number of 206 mg of KOH/g and an acid number of 56 mg of KOH/g were obtained.

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**Table 1: Applications properties of alkenylsuccinic acid
3-alkoxypropylamides**

Example	1	2	3	4	5
5 Appearance of 3 % strength aqueous solutions: distilled water immediately after 24 hrs	clear clear	clear trans- parent	clear clear	clear clear	clear clear
10 Foam height ¹⁾ immediately after 5 mins	> 50 > 50	> 50 > 50	> 50 > 50	> 50 20	> 50 12
15 20°dN immediately after 24 hrs	clear clear	trans- parent trans- parent	clear clear	clear clear	cloudy cloudy
Foam height ¹⁾ immediately after 5 mins	> 50 3	50 45	> 50 > 50	> 50 trace of marginal foam	45 2
20 Corrosion protection a.) Herbert test (DIN 51360/1) distilled H ₂ O 1.0 % 20°dN 3.0 %	Ro/so Ro/so	Ro/so Ro/so	Ro/so Ro/so	Ro/so Ro/so	Ro/so Ro/so
25 b.) Filter paper test (DIN 51360/2) distilled H ₂ O 1.5 % 20°dN 3.0 %	0 0	1 0	0 0	0 0	1 0
Emulsifiability	apon- taneous	apon- taneous	apon- taneous	apon- taneous	apon- taneous

Notes on Table 1:

- 30 1) To determine the foaming properties, in each case
50 ml of 3 % strength aqueous solutions of the test
products were introduced into a graduated 100 ml
measuring cylinder and the cylinder was closed with
a glass stopper and shaken vigorously 20 x in the
horizontal direction. The evaluation was carried out
after the waiting periods stated by measuring the
amount of foam in ml.

Information on the test procedure:

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The tests were carried out on formulations comprising:

- 18 % of emulsifier mixture
- 4 % of nonylphenol ethoxylate
- 2 % of water
- 5 78 % of naphthene-based mineral oil

Emulsifier mixture:

- 37 % of product according to the example
- 32 % of oleyl alcohol + 2EO (ethylene oxide)
- 31 % of tall oil fatty acid diethanolamide

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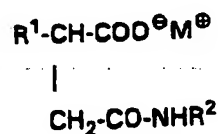
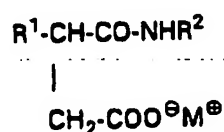
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Patent claims:

1. A salt of an alkenylsuccinic acid alkoxyalkyl-half-amide of the formula Ia or Ib

Ia

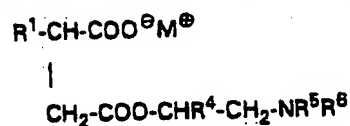
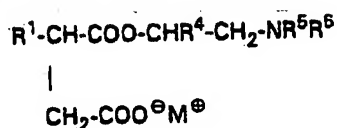
Ib



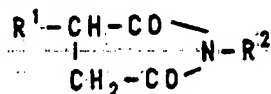
- 5 if appropriate as a mixture with a salt of an alkenylsuccinic acid half-ester amine of the formula IIa or IIb

IIa

IIb



and/or an alkenylsuccinic acid imide of the formula III



III

in which

- 10 R^1 is $\text{C}_6\text{-C}_{30}$ -alkenyl or $\text{C}_6\text{-C}_{30}$ -alkyl, preferably $\text{C}_6\text{-C}_{18}$ -alkenyl or $\text{C}_6\text{-C}_{18}$ -alkyl, in which R^1 can be straight-chain or branched;
- R^2 is $-(\text{CH}_2)_n\text{-O-(A)}_m\text{-R}^3$, where
- 15 A is $-\text{CH}_2\text{-CH}_2\text{-O-}$ or $-\text{CH(R}^4\text{)-CH}_2\text{-O-}$, in which
- R^3 is $\text{C}_1\text{-C}_{18}$ -alkyl, and in which R^3 can be straight-chain or branched,
- R^4 is hydrogen or methyl,
- n is a number from 1 to 6,
- m is a number from 0 to 8 and
- 20 M^\oplus is an alkali metal or alkaline earth metal cation

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or an ammonium ion of the formula $\text{HNR}^3\text{R}^4\text{R}^5$, in which R^3 , R^4 and R^5 are identical or different and are hydrogen, C_1 - C_6 -alkyl or hydroxy- $(\text{C}_1$ - C_6)-alkyl,

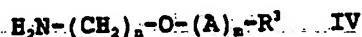
5

in particular

2-hydroxyethyl and 2-hydroxypropyl.

2. A compound as claimed in claim 1, wherein a salt of an alkenylsuccinic acid half-ester amide of the formula IIa or IIb and an alkenylsuccinic acid imide of the formula III are present in a concentration of up to 40 % by weight, preferably up to 20 % by weight, as a mixture with a salt of an alkenylsuccinic acid alkoxyalkyl-half-amide of the formula Ia or Ib.

3. A process for the preparation of a salt of an alkenylsuccinic acid alkoxyalkyl-half-amide of the formula Ia or Ib, if appropriate as a mixture with a salt of an alkenylsuccinic acid half-ester amine of the formula IIa or IIb and/or an alkenylsuccinic acid imide of the formula III, which comprises reacting an alkenylsuccinic acid anhydride with an alkoxyalkylamine of the formula IV



in which

R^3 is C_1 - C_{18} -alkyl, in which R^3 can be straight-chain or branched,

n is a number from 1 to 6 and

m is a number from 0 to 8,

in a molar ratio of 1 : 0.7 to 2.5, preferably 1 : 0.8 to 1.2, at temperatures of 20 to 120°C, preferably 60 to 100°C, and carrying out this reaction in the presence of an amount of base which is equimolar to the alkoxyalkylamine of the formula IV, or adding an amount of base equimolar to the alkoxyalkylamine of the formula IV after the

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reaction.

4. The process as claimed in claim 3, wherein an alkali metal hydroxide, alkaline earth metal hydroxide, alkanolamine of the formula NR^3R^4 or a mixture thereof is employed as the base.
5
5. The process as claimed in claim 3, wherein 2-hydroxyethylamine and/or 2-hydroxypropylamine are employed as the alkoxyalkylamine of the formula IV.
6. An aqueous or oil-containing formulation for working metals, in particular for use as a cooling lubricant, which comprises a salt of an alkenylsuccinic acid alkoxyalkyl-half-amide of the formula Ia or Ib, if appropriate as a mixture with a salt of an alkenylsuccinic acid half-ester amine of the formula IIa or IIb and/or an alkenylsuccinic acid imide of the formula III, as claimed in claim 1.
10
15
7. A formulation as claimed in claim 6, which comprises a compound as claimed in claim 1 in a concentration of 10 to 80 % by weight.
20
8. An aqueous or oil-containing metalworking fluid for working metals, in particular for use as a cooling lubricant, which comprises a salt of an alkenylsuccinic acid alkoxyalkyl-half-amide of the formula Ia or Ib, if appropriate as a mixture with a salt of an alkenylsuccinic acid half-ester amine of the formula IIa or IIb and/or an alkenylsuccinic acid imide of the formula III, as claimed in claim 1.
25
9. An aqueous and/or oil-containing metal working liquid as claimed in claim 8, which comprises compounds as claimed in claim 1 in a concentration of 0.1 to 10 % by weight, preferably 2 to 10 % by
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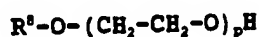
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weight.

10. A formulation as claimed in claim 6, which comprises as additional auxiliaries an oxyethylate of the formula V

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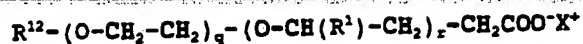
in which R^8 is C_{10} - C_{22} -alkyl, C_{10} - C_{22} alkenyl or alkylphenyl having a total of 10 to 20 carbon atoms and p is a number from 2 to 10, and/or a fatty acid alkanolamide of the formula VI

10



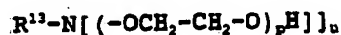
in which R^9 is C_{10} - C_{22} -alkyl or C_{10} - C_{22} -alkenyl and R^{10} and R^{11} are identical or different and are hydrogen or hydroxyl-(C_1 - C_6)-alkyl, in particular 2-hydroxyethyl or 2-hydroxypropyl, and/or an ether-carboxylic acid of the formula VII

15



in which R^{12} is a branched or unbranched C_8 - C_{22} -alkyl or C_8 - C_{22} -alkenyl radical and q and r independently of one another have values from 0 to 10, with the proviso that the sum of q and r is at least 1, and X is hydrogen, an alkali metal atom or an alkaline earth metal atom, an alkoxyated primary amine of the formula VIII

20



25

in which

R^{13} is C_{12} - C_{20} -alkyl, or alkenyl, preferably C_{16} - C_{18} -alkyl,

p is a number from 2 to 10, preferably 4 to 6, and u is the number 1 or 2, with the proviso that if u

30

is 1, a hydrogen atom is located on the free bond

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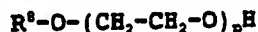
of the nitrogen atom,
and/or

5 a fatty acid polyglycol ester, in particular of a saturated or unsaturated fatty acid having 10 to 22 carbon atoms in the alkyl chain and 1 to 10 ethylene oxide units, preferably oleic acid having 4 to 6 ethylene oxide units.

11. A formulation as claimed in claim 10, which comprises the auxiliaries in a concentration of 20 to 40 % by weight.

12. A formulation as claimed in claim 6, which comprises a foam suppressant and/or preservative.

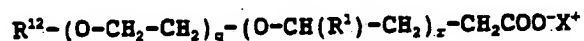
13. A metalworking fluid as claimed in claim 8, which comprises as additional auxiliaries an oxyethylate of the formula V



20 in which R^8 is C_{10} - C_{22} -alkyl, C_{10} - C_{22} alkenyl or alkylphenyl having a total of 10 to 20 carbon atoms and p is a number from 2 to 10, and/or a fatty acid alkanolamide of the formula VI



25 in which R^9 is C_{10} - C_{22} -alkyl or C_{10} - C_{22} -alkenyl and R^{10} and R^{11} are identical or different and are hydrogen or hydroxyl- (C_1-C_6) -alkyl, in particular 2-hydroxyethyl or 2-hydroxypropyl, and/or an ether-carboxylic acid of the formula VII



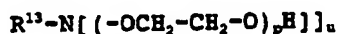
30 in which R^{12} is a branched or unbranched C_8 - C_{22} -alkyl or C_8 - C_{22} -alkenyl radical and q and r independently of one another have values

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from 0 to 10, with the proviso that the sum of q and r is at least 1, and X is hydrogen, an alkali metal atom or an alkaline earth metal atom, an alkoxylated primary amine of the formula VIII

5



in which

R¹³ is C₁₂-C₂₀-alkyl, or alkenyl, preferably C₁₆-C₁₈-alkyl,

10

p is a number from 2 to 10, preferably 4 to 6, and u is the number 1 or 2, with the proviso that if u is 1, a hydrogen atom is located on the free bond of the nitrogen atom,

and/or

15

a fatty acid polyglycol ester, in particular of a saturated or unsaturated fatty acid having 10 to 22 carbon atoms in the alkyl chain and 1 to 10 ethylene oxide units, preferably oleic acid having 4 to 6 ethylene oxide units.

20

14. The use of a salt of an alkenylsuccinic acid alkoxy-alkyl-half-amide of the formula Ia or Ib, if appropriate as a mixture with a salt of an alkenylsuccinic acid half-ester amine of the formula IIa or IIb and/or an alkenylsuccinic acid imide of the formula III as a metalworking auxiliary, in particular as an anticorrosion agent and emulsifier in an aqueous and/or oil-containing formulation or metalworking auxiliary.

25

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